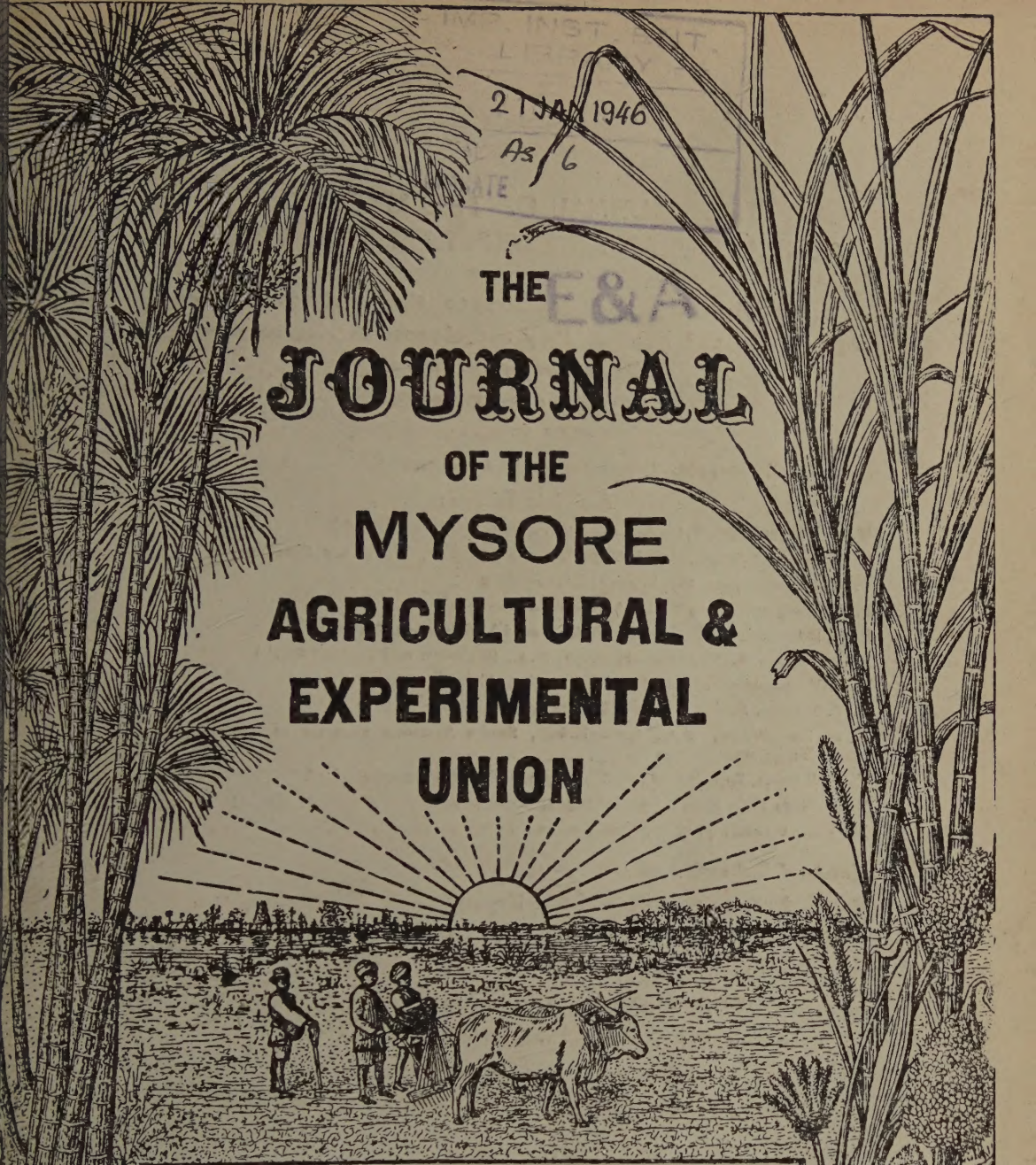
21 JAN 1946
As 6

THE JOURNAL OF THE MYSORE AGRICULTURAL & EXPERIMENTAL UNION



Vol. XIX] APR.—JUNE 1941 [No. 4

PRINCIPAL CONTENTS

Some Common Contagious Diseases of Sheep—
By S. D. Achar, G.B.V.C., P.G.

Control of Sugarcane Borers by the Egg Parasite *Trichogramma minutum* R. in Mysore—
By T. V. Subramanyam, Dip. in Agri.

Farmers in Mysore !

Have You an Agricultural Association in Your Locality ?

If not, why not form one ?

The advantages are many:

You can

(1) develop Agriculture on modern lines;
(2) make a profitable business out of Agriculture;
(3) try the Departmental methods and suggestions, co-operatively or individually;
(4) get improved seeds, fertilizers, and implements for your trials;
(5) make use of the Agricultural Library at the Head Office at Bangalore;
(6) educate the masses, in turn, to "Better Farming" practices;
(7) represent your problems and difficulties to the Agricultural Department and demand solutions.

After forming one, Affiliate it to the premier Agricultural Institution in Mysore

The Mysore Agricultural and Experimental Union.

For affiliation and membership apply for a copy of the Constitution and Rules to :

The Secretary

THE MYSORE AGRICULTURAL AND EXPERIMENTAL UNION
Seshadri Road, BANGALORE

The Journal
of the
Mysore Agricultural
and
Experimental Union

Vol. XIX] APR.—JUNE 1941 [No. 4

Editorial

The extension of cotton cultivation in Mandya and Malavalli Taluks has been progressing at a rapid rate. A Field-Day was held on the Irwin Canal Farm in the month of March which was attended by at least five hundred raiyats who were brought by bus to the Farm. There, they were shown round the plots where cotton with paddy as an inter-crop was grown and also where S. 705 paddy was being grown under irrigated conditions without resort to the usual puddling. The immense possibilities of growing cotton as a money crop in this area and of growing S. 705 paddy from the health point of view were explained to the raiyats in great detail by the Director of Agriculture. One might say that this visit to the Farm by the raiyats gave a better fillip to the extension of cotton cultivation, than all the propaganda done before, in the villages in this connection.

The keen interest evinced by the Second Member of Council in visiting on the 11th of May an interior village, Boppasandra, where the whole village has grown cotton to an extent of 100 acres has given considerable encouragement to the raiyats.

Two associations connected with the Agricultural activities have been recently started: (1) The Mysore State

Poultry Association and (2) The Sheep Breeders' Association, Bangalore. The Department has already opened a large number of poultry farms managed by Veterinary Hospitals and Agricultural Farms and Schools; and we believe the formation of the Association will give a further impetus to the raiyats around the poultry centres to adopt this industry on improved lines. The second is the fifth Sheep Breeders' Association started in this State, the four others having already been formed at Kolar, Mysore, Closepet and Channarayapatna.

On the side of crops also, the association between the Department and the farmers has been in evidence. The Subvention Farms are now a season old and several landholders are apprising us of the results. There were 556 "A" Farms for multiplication of improved seeds all over the State and there has been definite increase in the distribution of improved seeds by the Department of Agriculture.

Some Common Contagious Diseases of Sheep

BY

S. D. Achar, G.B.V.C., P.G.

Superintendent, Veterinary Services, Bangalore

He prayeth well who loveth well,
Both man and bird and beast;
He prayeth best who loveth best
All things both great and small;
For the dear God Who loveth us,
He made and loveth all.

COLERIDGE.

In an article on "Some Common Ailments of Sheep," which appeared in a previous issue of this *Journal* (Vol. VI, No. 1), I have touched upon some common *non-contagious* diseases and ready remedies. I would now briefly describe some common *contagious* diseases of sheep and the methods of combating them.

It is known that sheep breeding has come to be recognised as a most profitable occupation for the farmer. The only snag in this enterprise is the possibility of an outbreak of one or the other of the contagious diseases among the flock.

But this need not any longer hold out a threat or create a sense of despair as it used to, prior to the discovery of vaccines and preventive inoculations. It is fortunate also that there are comparatively few epizootic diseases of sheep and they are all preventable by skilful aid and proper care. Some of these contagious diseases affect sheep only, in which case, they cause, if not prevented from spreading, heavy loss of life among them and loss of money to the stock owners. Others, like rinderpest, are more serious, being communicable to cattle and still others, like anthrax and foot and mouth are more serious as they may spread to other animals and even to men.

It is therefore incumbent on every stock raiser to know at least something about these would-be invaders and the measures necessary to prevent their incursion and to check their spread.

In all cases of epizootics, please remember two things, first and foremost attend to proper housing, good food, sufficient water and thorough cleanliness as these are quite necessary to create in your animals what is known as "everyday immunity", so as to keep up their vitality and to increase their powers of resistance to diseases; and next, at the onset of any disease, immediately wire or write to your nearest Veterinary Inspector or to the Superintendent, Veterinary Services.

Within the limits, that the Editor imposes upon me, I can only make mention of the more common contagious diseases and refer to them only very briefly.

Now for the diseases, against which you might have to protect your sheep:—

A. Virus Diseases

1. *Sheep Pox.*—This is an acute infectious disease which takes a heavy toll frequently and causes great economic loss as even the surviving sheep have to undergo a long convalescent period before complete recovery. The hides, too, become useless on account of the lesions of the disease and the shepherd is deprived even of their value.

Symptoms.—Fever, quickened breathing and loss of appetite. A couple of days later eruptions in various parts of the body, especially where wool is scarce. These eruptions are reddish at first, later enlarge and develop into well-defined hard elevations. These change into flat topped vesicles surrounded by a small red ring. These vesicles are at first clear but become turbid a couple of days after. About two to three days later the pustules begin to dry; scales or crusts are formed, which peel off leaving small pits or pock marks.

Treatment and Prevention.—Separate the healthy from the sick sheep. Attend to cleanliness of the sick sheep.

Syringe out their nostrils frequently. Give "ragi conjee" which is cooling and easily digestible. The pustules should be protected from flies by an application of a paste of Margosa leaves and turmeric or by any other suitable dressing.

Under the village conditions that exist here the only possible preventive measure that can be adopted is vaccination of all the sheep of the village where the disease exists or is likely to appear.

A very effective vaccine from the local strains of virus is manufactured at the Mysore Serum Institute, Hebbal, and supplied to all parts of Mysore and to many other places in India. Vaccinations are conducted free by the local Veterinary Officers.

2. *Rinderpest.*—This is a common disease among cattle but in recent years many natural outbreaks with heavy mortality among sheep have been brought to light.

Symptoms.—Almost every cattle owner is familiar with the symptoms of this common disease of cattle. All the symptoms, such as fever, the characteristic ulceration of the mouth, diarrhœa and dysentery are exhibited in the sheep also. Pulmonary complications are more frequent. The duration of the disease is slightly shorter than in cattle being five days to a week.

Treatment and Prevention.—Curative treatment by drenching medicines is neither practical nor useful in sheep. Often on account of the pulmonary complications that will have set in, drenching may be harmful.

The disease can be very effectively controlled by vaccination. Goat rinderpest virus accompanied by a protective dose of anti-rinderpest serum is quite reliable and safe. Large doses of anti-rinderpest serum injected in the early stages of the disease helps in recovery. The necessary vaccine and serum are prepared at the Mysore Serum Institute and the inoculations are conducted free by the local Veterinary Officers.

3. *Foot and Mouth Disease.*—This is another highly contagious disease but fortunately it is not so fatal in India

as it is in the Western countries. But the affected sheep lose condition rapidly and take long to recover thus causing heavy economic loss.

Symptoms.—High temperature, loss of appetite, soreness of mouth and a severe lameness.

Treatment.—No special treatment is necessary usually. With ordinary care it will run off a mild course with few complications. Give as much rest as possible and allow to the pasture during the dry weather. Driving the affected sheep on stubble fields and stony roads aggravates the trouble leading to severe injuries and suppuration in the foot. An antiseptic foot-bath of cyllin or copper sulphate lotion and the application of copper sulphate and coal tar to the feet and washing the mouth with potassium permanganate lotion will be found useful.

B. Bacterial Diseases

1. *Johne's Disease.*—This is really a dangerous disease, as it runs an insidious course like tuberculosis, the owner not being aware of it until many of his flock are affected. Once the disease gets a good foot-hold, its eradication is very difficult.

Symptoms.—Gradual emaciation in spite of a good appetite and a plentiful supply of food. The wool becomes rough and the yield greatly diminished. Diarrhœa sets in and emaciation becomes marked.

Treatment and Prevention.—The disease is under study and investigation at the Mysore Serum Institute under a scheme partly financed by the Imperial Council of Agricultural Research. It is hoped that a practical remedy will be evolved.

With our present limited knowledge, the only practical method of prevention of the spread of the disease is by slaughter of the affected animals at the earliest opportunity, thus removing the source of infection. This extreme step is recommended and should be followed as the infected sheep continue contaminating the pastures through their fæces. The whole of the flock and other susceptible animals such as cattle and goats may also get infected in due course.

As a palliative treatment, antiseptics and astringents may be administered in isolated cases of very valuable animals. A mixture of iron sulphate has proved beneficial in some cases.

2. *Anthrax.*—Perhaps this is the worst disease among sheep in our State. The disease is due to a specific microbe. The anthrax bacillus grows in the body of the animals and causes early death. It is popularly known by different vernacular names, depending upon the slightly different symptoms exhibited.

Symptoms.—The onset of the disease is sudden. A healthy grazing animal suddenly develops dizziness, staggers, falls down, stretches itself on one of its sides and dies even before one recognizes that the animal is ill while in the flock.

Soon after death the rumen gets bloated and there is a frothy and bloody discharge from the natural orifices. On opening the carcass one invariably finds a sero-gelatinous infiltration under the skin, tarry black blood which does not clot, and a severe enlargement of the spleen. The anus is usually everted.

The disease is easily recognised by any of the above symptoms and confirmed by a microscopical examination of a blood smear.

Treatment and Prevention.—A cure is almost impossible as the animals die before any remedial measures can be adopted. Prevention of the disease, which is possible, is the only measure to be adopted.

The following prophylactic measures are recommended:

The carcass of an animal dead of this disease, should never be cut or opened as this entails great danger. The person so engaged, is liable to contract the disease himself. The blood and other fluids contain the bacilli in large numbers which escape and contaminate the whole of the surrounding soil, where the bacilli form spores (seeds) in which form they will live for a long time. When these spores gain entry into other animals through a wound or by mouth they develop into bacilli and multiply rapidly and kill the animal quickly.

The carcass therefore should be burnt or buried deep with lime dressing. The mouth, nose and anus should be plugged to prevent the escape of blood and the animal carried carefully to the place of disposal.

The place where the animal dies, should be disinfected and this is best done by immediately burning straw all over.

Inoculation of sheep with anti-anthrax serum on the scene of outbreak suppresses the disease and prevents it from spreading. A special vaccine, prepared from a strain isolated from a virulent outbreak among sheep, has been prepared at the Mysore Serum Institute and is found to be very effective. On requisition the inoculations and vaccinations are conducted free by the Officers of the Civil Veterinary Department.

Control of the Sugarcane Borers by the Egg Parasite *Trichogramma minutum* R. in Mysore

BY

T. V. Subramanyam, Dip. in Agri.

Entomologist to Government of Mysore

Introduction

Due to the extensive planting of sugarcane year after year in the areas irrigated by the Irwin Canal in the Mandya District and the presence of sugarcane plants of all ages during more or less all the twelve months in the year, the most serious of the enemies of the sugarcane plant, *viz.*, the various kinds of borers have increased enormously. Anticipating the borer trouble, the Mysore Agricultural Department began a close study of the borers with a view to their control from the very beginning of sugarcane development in the area over eight years ago. Different control measures have been devised and one of these is the utilisation of the egg parasite, *Trichogramma minutum* R. This is a very minute wasp found in nature to lay its eggs on the groups of eggs laid on the sugarcane plants by two of the most serious of the cane borers commonly known as the "dead-heart borers" or "stem borers", *viz.*, (*i*) *Argyria sticticraspis* Hmp. and (*ii*) *Diatræa venosata* Wlk. The young ones hatching out of the wasp eggs feed on the egg contents of the borer eggs and develop into winged wasps in a very short time and prevent the borer larvæ from hatching out and cause serious damage to sugarcane. This wasp is also an egg parasite of various other crop pests. The initial success in the attempts to breed this parasite on a large scale in the laboratory at Bangalore, and the satisfactory results obtained in the release of these laboratory-bred parasites on the control of the borers in the Government sugarcane farm (Irwin Canal Farm) and some of the Sugar Company's farms at Mandya, led to the establishment in 1934–35 of a parasite laboratory at Mandya—a small town situated in

the centre of sugarcane areas—for the large-scale production of this egg parasite. The following table gives the progressive rate of its production in the laboratory and the area of sugarcane over which the parasites were released from the time the parasite laboratory started work.

TABLE I

Progressive rate of parasite production and their releases in the cane areas since the establishment of the laboratory.

Year	Number of parasites produced	Area covered in acres	Remarks
1934–35 ..	2,75,500	12	
1935–36 ..	5,37,000	16	
(Jan. to June 1936) 1936–37 ..	38,76,500	193	
1937–38 ..	10,27,300	630	
1938–39 ..	1,16,13,750	1,005	Sugar Company's farms 610 acres Raiyats' cane area 340 ,, Government farms 35 ,, North India 20 ,,
1939–40 ..	98,81,000	881	Sugar Company's farms 490 ,, Raiyats' cane area 282 ,, Government farms 62 ,, North India 47 ,,

The Mysore Sugar Company, Mandya, provided additional equipment in 1937 for the increased production of the parasites for their utilisation in the farms of the Company so that it was possible to increase the production of the parasites in the laboratory to a considerable extent. At present the laboratory is able to produce parasites to cover an area of about 1,000 acres of sugarcane.

Parasites were supplied every year from 1937 to Mr. P. V. Isaac, Entomologist, in charge of the Imperial Council of Agricultural Research Scheme for research on sugarcane pests, New Delhi, for trials in the control of the cane borers in North India. This Officer arranged for the release of the parasites in sugarcane fields on a small scale in Orissa and on a large scale in Bihar.

Although the parasites were found to reduce appreciably the population of the pest in the parasite-released sugarcane areas in Mysore, under South Indian conditions, the Agricultural Department was anxious to find out how far the parasites could be utilised for the cane borer control under North Indian conditions.

Technique of Release

Technique employed in the large-scale production of the parasites and preliminary experiments on their mass production, and results of small-scale releases in the sugarcane fields have already been published in Bulletin No. 12, Entomological Series, Mysore Department of Agriculture, 1940, and the *Indian Journal of Agricultural Science,* Vol. VII, Part 1, February 1937. The method of control of the sugarcane borers by the release of the parasites in the fields, known as the "Biological method" consists in the release on every acre about 3,000 parasites every week for eight weeks from about the sixth week after planting.

Two methods are adopted in releasing the laboratory produced parasites in the fields, *viz.,* (1) the cards containing the *Trichogramma* parasitised eggs are taken to the cane fields before the parasites emerge. Strips are cut from the cards and distributed evenly over the selected cane area by either pinning them on the cane leaves or wedging them in between the leaves and the shoots; (2) the parasite cards are put into a wide-mouthed jar and the parasites are allowed to emerge. The jar is taken to the cane field and a man walks over the area with the lid of the jar open, enabling all the parasites to escape. The latter method has been found to be more suitable and efficient.

Results of Parasite Releases

Two important items are taken into consideration in evaluating the results of the parasite releases in the sugarcane areas in the control of the borers. These are (*i*) the percentages of parasitisation of the sugarcane borer eggs in the parasite released areas compared with those in the control

areas; (*ii*) the comparison of the tonnage of canes obtained at harvest time in the parasite released areas and the controls. With regard to the first item a marked increase in the parasitisation of the borer eggs was noticed in the parasite released cane areas as a result of parasite releases. From an initial parasitisation of 0 per cent. and 13.5 per cent. it increased to 62 per cent. and 90 per cent. With regard to the second item, the harvest figures for 3 years, 1935–36 to 1937–38, for the parasite released areas and control areas (in about 106 scattered areas from a minimum of one acre to a maximum of 8 acres), were statistically evaluated. The Statistician reports that "in 95% of the cases, the parasite released plots yielded more than the control". As regards the effectiveness of the seasons of planting, A and B, the following indication is present in the mean yields calculated:—

	Season "A"*	Season "B"*
Treated plots ..	28·91 tons per acre	32·32 tons per acre
Control ..	21·40 „ „	29·70 „ „

* 'A' Season plantings are summer plantings, February to May; and 'B' Season, July to October.

The marked difference in the yield between the treated and control in 'A' season as compared with 'B' season noted above is explained by the fact that the damage to canes by the borer is at its maximum in the 'A' season and in the 'B' season it is at its minimum.

Results of Parasite Releases in Northern India

In his report on the results of parasite releases in Orissa in 1937 and 1938, Mr. P. V. Isaac, Entomologist in charge of the Imperial Council of Agricultural Research scheme for research on sugarcane pests, states as follows:—

"The results of the two seasons' experiments showed that the parasite does reduce to an appreciable degree the population of the pest in the parasite released plots. In the *Trichogramma* distributed blocks it was seen at harvest time that the borer attack in mature canes was much less when

compared to the control fields and the yield was also higher by about 100 maunds per acre (Bengal maund) and of much better quality."

With regard to the results of parasite releases in Bihar in 1939, the same Officer reports as follows:—

"Fortnightly counts of 'dead hearts' collected at random from the experimental and control plots during the course of experiments showed a marked decrease in the experimental plots. In the experimental plot at Lalseriya (Bihar), the number of 'dead hearts' per chain length was 23.5 while in the control plot it was 47.3."

Conclusion

It will be seen that the parasite releases in the sugarcane fields for the control of 'dead heart' borers, which are the most serious of the borers present, more or less throughout the cane-growing tracts in India, have been found to reduce the borer population not only under South Indian conditions but also under the varied conditions of climate, cultivation, etc., of Northern India. The parasites sent from Mandya by post had stood the journey to Bihar, of about five days, very well, thus showing that with ordinary precautions, the parasites could safely be transported by post to any part of India.

The present equipment of the parasitic laboratory at Mandya, the only laboratory of its kind in India, is capable of producing parasites for the control of the 'dead heart' borers in about 1,000 acres of sugarcane. Considering the very large areas under sugarcane every year in the Irwin Canal tract, the parasitic laboratory will have to be enlarged several times before it will be able to supply parasites for the control of the borers, to at least a fairly good portion of the cane area.

It has to be mentioned here that *the release of the parasites alone* will not give the maximum borer control, but other borer control methods recommended by the Department should also be adopted by the sugarcane growers to get the maximum control.

Population and Crop Production in Mysore

The preliminary report of the Census in Mysore for 1941 is to hand. The total population of the State which was 65,57,302 in 1931 has increased to 73,28,896, proving the correctness of the forecast made in the report of the last Census. This leads one to think whether the food production in the State is keeping pace with this.

The two important food crops in the State are rice and ragi and one is inclined at the outset to see if any trend in the population is reflected in any trend in the acreage and production of these crops.

First let us see the acreage under paddy. The highest acreage under this crop between 1904–05 and 1934–35 was 818,347 acres in 1917–18. The lowest during the same period was 634,456 in 1918–19. In the decade 1927–28 to 1937–38 the acreages varied as follows: —

Year	Acres
1927–28	704,376
1928–29	707,470
1929–30	720,825
1930–31	742,761
1931–32	731,300
1932–33	770,277
1933–34	774,397
1934–35	679,907
1935–36	744,472
1936–37	726,388
1937–38	707,670

There is not much change in this acreage as the figures show.

In the absence of local production the population would depend on imports and rice has indeed been one of the agricultural products largely imported into the State.

The following figures are instructive:—

Lowest quantity imported in any one year between 1913–14 and 1926–27, in 1913–14 } 730,100 Ry. mds.

Highest quantity imported in any one year between 1913–14 and 1926–27, in 1924–25 } 1,673,689 Ry. mds.

Year	Import in railway maunds per year
1927–28	1,462,805
1928–29	1,630,642
1929–30	1,483,085
1930–31	1,110,397
1931–32	1,206,855
1932–33	1,356,405
1933–34	1,238,132
1934–35	2,048,339
1935–36	2,259,381
1936–37	1,336,707
1937–38	1,183,572

Thus the imports of rice are practically constant.

With regard to ragi the highest acreage under this crop between 1904–05 and 1934–35 was in 1912–13, 2,335,207 acres. The lowest acreage was during the same period, 1,966,411 acres in 1918–19. The acreage in the several years from 1927–28 to 1937–38 was as follows:—

Year	Acres
1927–28	2,298,513
1928–29	2,326,262
1929–30	2,258,854
1930–31	2,278,686
1931–32	2,260,250
1932–33	2,311,445
1933–34	2,282,736
1934–35	2,116,365
1935–36	2,204,802
1936–37	2,220,537
1937–38	2,158,969

Here also as in the case of paddy we do not see much variation.

Unlike rice, ragi so far as it figures in the commerce of the State is one of the products that is exported and the

Director of Agriculture in his address to the Mysore Civil Services Association bases his argument on the exportable surplus of this product as being indicative of the trend in the population of the State. Thus while the population has increased the export of ragi has decreased, as the following figures indicate.

Except for the years 1919–20 and 1920–21 when unusually low quantities of ragi were exported, the high water-mark between 1913–14 and 1926–27 was 763,543 maunds in 1916–17 and the low water-mark during the same period, 189,089 maunds in 1924–25. The figures for several years between 1927–28 and 1937–38 are as follows:—

Year	Mds. of Ragi exported
1927–28	.. 591,946
1928–29	.. 385,231
1929–30	.. 222,741
1930–31	.. 199,557
1931–32	.. 163,365
1932–33	.. 138,944
1933–34	.. 128,741
1934–35	.. 65,955
1935–36	.. 18,059
1936–37	.. 17,473
1937–38	.. 19,433

In 1927–28 a quantity of 591,946 maunds has been exported which is about 6% of the total production of ragi in that year estimable at 9,578,107 maunds. In 1937–38 the exports stand at 19,433 maunds against a total production of 13,887,229 maunds. (A maund = $82^2/_3$ lbs.)

The area under ragi is 42 per cent. of the extent under all food crops and 34.5 per cent. of the net cropped area, and is about thrice larger than the area under any of the crops next in extent to it, paddy, jola or horsegram. The important relation this huge extent of land bears to the pressure of

population has come under notice ever since the inception of definite agricultural improvement in the State. The total production cannot be allowed to go down; if that is kept up along with a parallel improvement in the yield per acre, the acreage required may perhaps be minimised; there might then be a possibility of growing more remunerative crops in the area so released.

One cannot fail to see the challenge offered by the growth of the population to the agricultural resources of the State.

M. V.

A Preliminary Note on the Cultivation of Flax (*Linum usitassimum*) and Extraction of Fibre

BY

Dr. L. S. Dorasami, M.Sc. (Lond.), Ph.D. (Lond.)
Economic Botanist

Linum usitassimum belonging to the order of Lineacæ is grown in various countries either for seed, *i.e.*, for extraction of linseed oil or for fibre. Amongst Western countries, United States of America, Russia and Ireland grow it for fibre whilst India and Argentina cultivate this crop for seed. The morphological variations between these two economic crops are quite distinct. The branches of *Linum usitassimum* grown for seed purposes are slender, and they arise from the base of the stem in large numbers above the ground level. Each branch bears at its terminal portion branchlets from which arise flowers resulting in seeds ultimately. The flax plants on the other hand are characterised by a short period of growth, possess long slender stems with no branching at the base and with a relatively few terminal branches forming the inflorescence and produce small quantities of seeds. Both the economic varieties have small linear leaves with white or blue flowers arranged in the form of a panicle.

The flax plant has been used as a source for fibre in the manufacture of textiles from a very long time. The fibres obtained from this are used in the manufacture of linen, which are found to be the best. Even in these days when other fibres such as wool, cotton, natural and artificial silk have gained great prominence, the supremacy of the flax fibre is still unchallenged. The fibres are still unrivalled for textile fabrics when strength and lightness count. The commercial valuation of flax fibre is dependent on the fineness, colour, length and strength.

The demand for these fibres at present is great. Prior to the war, England was importing nearly 60,000 tons of

Flax grown at Hebbal—Variety J.W.S.

Flax grown at Hebbal—Variety Liral Dominion

linen fibre every year. The bulk of the imports came from Russia and Ireland. The Empire countries supplied only 2 to 3 per cent. of the demand. Except Bengal, no other parts of India cultivated flax. But owing to the increased demand for this fibre during the war time, the Imperial Government have recently given a subsidy of Rs. 4,50,000, to the Governments of Bengal and Bihar Provinces for large-scale cultivation of flax.

Recently and for the first time the Department of Agriculture, Mysore, tried the cultivation of flax at the Hebbal and Irwin Canal Farms. Nearly 13 varieties, reported to have yielded good fibre were imported from Ireland and United States of America. Preliminary experiments indicated that flax could be grown under our conditions. Further small-scale seasonal experiments disclosed that flax could be cultivated throughout the year, but the best crop was obtained when planted during the winter months—October and November—and harvested during March.

The flax plant matures in about 3½ months and flourishes in loamy soils capable of retaining moisture. In soils which are too light, the crop is liable to be stunted and in rich soils the crop tends to lodge and become coarse. The land selected for growing flax has to be well prepared. To ensure uniform germination and a good stand, the preparation of an "even-bed with as fine a tilth as possible" is essential. Shallow sowing of seeds gives a better germination. The seeds are either broadcast or are sown in lines four inches apart. In the cultivation of flax, close planting is resorted to, to avoid lodging, and branching habit and growth of weeds. Irrigation should be given only when there is insufficiency of moisture. No interculture is necessary. Above all, it must be remembered that flax does not tolerate weeds and at the risk of sowing a little late the ground should be kept free from weeds and the preparatory cultivation done very thoroughly.

The seed rate varies from 70 to 100 lbs. per acre. The seed rate in Australia is 70 lbs. to an acre, whilst in

New Zealand it is 100 lbs. In Bengal seeds are broadcast and the land is manured with 12,400 lbs. of farmyard manure and chemical manure in the shape of either niciphos or ammophos is given at the rate of 1½ cwts. per acre. In New Zealand the rate of chemical manure varies from 1 to 3 cwts. per acre and this is given in the shape of superphosphate. To obtain better and more fibre potash is given in a very small quantity. Ammonium sulphate is never given as it produces rank growth. Judicious manuring with a view to obtaining an erect and non-lodging crop must be practised.

Harvesting is done in 3 to 3½ months after sowing and it must be taken up at the correct time. If harvested too early, the yield will be low; the fibres though soft and fine will lack strength. If harvested late, the fibres become coarse and harsh. Harvesting is therefore taken up when the plants turn yellow and the seed pods are nearly all-brown. If in doubt, it is better to take a few seed pods, cut them in halves and squeeze them, and if any moisture can be squeezed out the crop is not ready for pulling; otherwise pulling can start. To avoid any loss of fibre and to prevent changes in the strength of the fibre, it is advised to pull the plants with their roots at harvesting period.

After the plants are harvested they are dried and the seeds removed. When perfectly dry the de-seeded straw is made up into small bundles and immersed in water for 72 to 96 hours for retting. When retting is complete, the bundles are removed from the water and spread evenly on the ground to dry. The dried straw is then passed through a roller mill three or four times to break the pith. If no mills are available, the retted straw is beaten with a wooden mallet though the process is cumbersome and slow. Then the broken straw is scutched. The process of scutching consists in removing the adhering piths and yielding a straight and clean fibre.

The yield of fibre varies from country to country. In Bengal the yield is 4 mds. of seed, 30 to 40 mds. of de-seeded straw and 4 to 6 mds. of clean fibre. In New Zealand the

yield is 450 lbs. of seed, 4,000 lbs. of straw and 700 lbs. of fibre. In most of the European countries the yield of clean fibre varies from 350 to 700 lbs. per acre. The average value of linen fibre is approximately between £60 to £100 per ton.

It will not be premature or presumptuous to mention that there is every possibility of raising a good crop of flax in the red-loamy soils under irrigation in the Irwin Canal area. It is earnestly hoped that with the multiplication of the seeds of several varieties it would be possible to grow these varieties of flax under a larger area and obtain further figures during the coming season.

S. 139 Paddy in Yelandur

BY

Y. N. Shama Rao, B.A.
Land-holder, Agara, Yelandur

The Agara tank in the Yelandur *Jahagir* is a fairly big tank having an *atchkat* of nearly 2,000 acres. Paddy and sugarcane are the main crops under this tank, though there is a good acreage of mulberry. Onions and brinjals are also grown side by side to a small extent. The cultivation is very intensive yielding good returns. The soil is mainly of black cotton type; patches of sand and red earth are also found.

Coimbatore fine, *kembuti, chambe, kaddi sanna, bili bangarkaddi,* and *Chintamani sanna* are the several varieties of paddy grown in this area.

Coimbatore fine gives the heaviest yield of grain though not a corresponding yield of straw, which is thin and wiry. Cattle do not relish it to the same degree as they would do the straw of the coarser variety of paddy. The general notion and experience, to a certain extent, of the raiyats are that the straw of the fine paddy is not nutritious and that the bullocks fed mainly on this straw lose their condition.

Chambe or *bili bhatta* is preferred by the raiyats here, because this variety is hardier than the fine paddy and yields more straw. The duration of the crop of this variety is 2 to 3 weeks longer than that of the fine paddy. The important consideration with the raiyat is that he wants good quality and quantity of straw in the variety of paddy that he grows. He has in view the welfare of his bullocks more than the quality of paddy. This variety, *chambe*, is readily saleable because of its white rice. The area under this paddy is greater than that under the fine variety. In spite of all this the seed of the *chambe* paddy has degenerated

being used over and over again on the same land. It has become impure and the seed now available is an admixture of several varieties of paddy.

It has been my experience as is that of others also, that changing of seeds at least once in four years gives a better return than using the same seed year after year continuously.

It was with these considerations that I wanted a variety of paddy which would give a very good tonnage of straw together with a fair yield of grain. The percentage of rice to paddy was also a consideration to me. The duration of the crop was not to exceed that of the local *chambe*.

In order to procure a seed which answered all my requirements, I went to the Nagenhalli Paddy Breeding Station, in March 1938, to select a variety. After a perusal of the charts maintained on the farm, giving the comparative yields of the several varieties and their behaviour year after year, I fixed up the variety, S. 139.

This is a coarse variety of paddy taking less than five months from transplantation to harvest. The grains are longer and a little thinner than those of the local *chambe*.

I purchased 50 seers of seed for my personal use and it was sown that year.

The land measuring 1 acre and 16 guntas had been ploughed immediately after reaping the previous paddy crop in December 1937. Two ploughings were given. Again in the month of May 1938, soon after *mungar* showers, the land was ploughed twice and green manure seeds of sun hemp, *daincha* and horsegram were sown at the rate of 12 seers per acre. A portion in the field, nearly 4 guntas in extent, was utilised for the nursery.

The nursery bed was kept being ploughed now and then about 6 times and the soil was completely sunbaked till it was devoid of big lumps and quite powdery. Farmyard manure, about 2 cartloads, was spread evenly on this area during the end of May itself. Thirty seers of paddy seed which works to a seed rate of 24 seers per acre in the field, was sown dry about the middle of June. The land was

watered once in order to supply the paddy seed with enough moisture to germinate. The plot was kept irrigated once in 10 to 12 days, just to see that the seedlings did not die for want of moisture. During the beginning of August, water was let into the main field, which was ploughed twice, puddled well, levelled and allowed to digest the green manure that was ploughed in. After about a week's rotting of green manure, the mainland was finally ready and seedlings from the nursery were transplanted in it.

Nearly a month after transplanting, the field was weeded and water supply almost stopped so that the field might almost dry up. No sooner this drying was noticed water was again let in. This is done in order that the plants may be rooted firmly and not shake with the wind.

The field was harvested in the beginning of January and it yielded 3,500 seers of grain and approximately 6,500 lbs. of straw, *i.e.,* 2,475 seers of grain and 4,700 lbs. of straw per acre.

The crop grew to a height of nearly 4½ to 5 feet and fell down due to the weight of the earheads. There were nearly 250 to 280 grains in each earhead. It was expected that since the crop fell down there would be too much chaff and loss of grain but that did not happen.

I thought further trials were necessary and so, I kept the entire quantity for purposes of seed to be tried in my lands at other places also. Nearly 40 acres were sown by the raiyats in this village and in four other villages of this taluk during the season of June and July 1939.

This season was not a good season for us because there were no timely rains and the tank did not get its supply of water in time. The plants in the seed bed became over-aged and were even condemned by many old raiyats as they thought it ruinous to plant these, the apprehension being that the seedlings would flower soon after transplanting without tillering and growing and thus there would be a failure of the crop.

Since it was already the middle of September there was no time for sowing in a separate nursery and it was not

also perfectly in season. Therefore in another field of mine, I put in plenty of manure, consisting of farmyard manure and the waste pupæ of the silk worm, together with the green manure crop which had been raised on the land, and got the field transplanted with the seedlings that were available. The crop was harvested in the middle of January 1941.

All the other varieties of paddy planted in our area failed and the failure was the maximum in the case of fine paddy. But this year also, my fields grew to a height of 5½ feet and the whole crop fell down soon after the earheads were full. At this stage, I was made to feel that I ought to have taken the suggestion of the older raiyats and sown a fresh seed-bed instead of spending so much on planting these over-aged seedlings, because the results of harvesting of other varieties of paddy showed that in all cases where the crop had fallen the yield was affected to a very large degree.

But since my seedlings were sown in time and the field was well prepared and very heavily manured, the seedlings rooted immediately and took up a vigorous growth. The earheads were satisfactory in comparison with the other varieties, considering the age of the plant in the seed-bed. The straw was so long that many people could not thrash it during the time of harvest, and it was an effort to take a swing with it.

After harvesting the yield was found to be 1,900 seers of grain per acre, whereas the G.E.B. 24, the standard paddy averaged 1,000 seers per acre only.

The raiyats after being convinced of the superiority of this strain (S. 139) took to it well and as far as I am aware nearly 300 acres in the locality have been sown with this paddy this year. This year also paddy has put up much vegetative growth and the yield of straw exceeds 5,000 lbs. per acre though there has not been a corresponding increase in the yield of grain. Fields which were manured well and where the height of the crop did not exceed 4 to 4½ feet have given satisfactory results. One of my fields, 1 acre and

2 guntas in extent, has yielded 2,400 seers of grain and 5,000 lbs. of straw, whereas the plot next to it, 27 guntas in extent yielded 1,200 seers of grain and 3,200 lbs. of straw. This plot had grown 5 feet high whereas the former was only four feet in height, all the other treatments of manure, ploughing and planting being the same.

This paddy has not given good results as a dry paddy, *i.e.*, when sown dry in June, the field being kept dry till September and then irrigated. This has not also thrived well where cultivation has been less intensive. Another defect in this variety is that it falls down, the straw not being strong enough to stand erect.

Advantages are that this paddy gives a good percentage of rice both ordinary and boiled. The rice is unbroken and of better quality than that of the local coarse paddy. It fetches 2 to 4 annas per palla more than the local variety. The earheads will not shed though they may be allowed to dry in the field for more than 4 days, whereas in the local variety nearly 25 per cent. shedding will occur. Even in this harvest of January 1941, this variety has shown its superiority over the local variety and there is every chance that the area under it may further be increased.

Cumin Cultivation

BY

D. Shivasankariah
Land-holder, Challakere, Chitaldrug District

Trial.—This crop was tried on a small plot of 8 guntas.

Season.—Early November seems to be the proper season to sow this crop in the locality.

Preparation of land.—The plot is ploughed twice, manured at the rate of one cartload of cattle manure (or compost) a gunta, cross ploughed again twice to incorporate the manure into the soil, cultivated to level the ground, and laid into beds of suitable size for irrigation.

Seed.—Seed is broadcast in these beds at the rate of about half a pound to each gunta or less.

First watering and weeding.—The beds are irrigated immediately the seeds are sown and again on the 3rd day and 6th day. The plot is hand weeded lightly on the 5th day.

Germination.—With this treatment complete germination may be observed by the ninth day.

Duration of the crop is about 3 months.

Diseases.—The crop may be attacked by mildew in which case it may be dusted with sulphur.

[Those who may try this crop in their plots are invited to kindly intimate their experiences and a few further trials may help to estimate the likely cost of cultivation and yields in our conditions.—EDITOR.]

Turmeric Cultivation at Goribidnur (Kolar District)

BY

T. D. Chayapathy

Agricultural Inspector

Rotation.—Turmeric is rotated with jola, sugarcane and ragi.

Soil.—It is grown in black soils as well as in red and sandy loams.

Preliminary Cultivation.—At the outset, the land is ploughed 6 to 8 times with the country plough which is equivalent to 3 ploughings with the improved plough.

Cattle manure is then applied to the land at the rate of 20 to 30 cartloads per acre.

After this, the country plough is so worked as to open furrows, each 6 inches wide. Water channels are opened across these furrows, cutting the land into strips 6 feet broad. Along the lengths of the strips again, cross bunds are raised at every 6 feet. Thus on either side of a water channel are formed beds, each 6 feet square, full of the ½-ft. wide furrows originally opened into which water may be easily led.

Planting.—Turmeric rhizomes are dibbled in these furrows, there being a foot between one rhizome and the other in the furrow.

Seed rate.—The seed rate works out to 40 to 50 maunds of 25 lbs. each, per acre.

Shade.—Generally tree castor is planted on the cross bunds to afford shade to the main crop of turmeric.

Season.—Turmeric is generally dibbled in the *'Bharani'* rain, the time of planting being often extended to the close of the *'Rohini'* rain (end of April to 1st week of June).

Weeding.—Four to six weedings are done in the course of 3 to 4 months.

Earthing up.—The rows are earthed up during the fourth month.

Irrigation.—According to the nature of the soil, the land is irrigated either once or twice a week.

Maturing.—The crop will be ready for harvest in 10 months' time.

Yield.—An acre of turmeric yields 400 to 500 maunds of the fresh produce.

Harvesting and Curing.—Turmeric is harvested by pulling the whole plants out. Rhizomes are then separated. For purposes of curing the big central rhizomes are each cut into pieces of convenient sizes while the smaller side ones are boiled whole, in water, in jaggery boiling pans or in earthenware pots of suitable capacity. When the rhizomes are well boiled they should be soft to the touch at the core. They are then dried in the sun. The drying may continue for 8 to 10 days continuously. After they are well dried the rhizomes are rubbed on stone slabs so that roots adhering to them may be removed, and they might have a clean appearance. Some people colour the turmeric by further rubbing the rhizomes with a sprinkle of turmeric water itself.

Cured Yield.—The average yield of cured turmeric per acre will be from 100 to 150 maunds.

Kar Ragi Subvention Farm

The idea behind subvention farms has already been described in the previous issues of our *Journal*. It is for purposes of obtaining definite results that problems allotted to these farms are reduced to simple terms like trial of a few selected varieties of crops and a few manurial formulæ. The tests conducted on these farms have the scope of raising the general level of Agriculture as a whole. The nomenclature given to these projects at present suggests the procedure adopted, but the more important point in this attempt lies in the fact that landholders themselves are the experimenters. Subvention farms are now opened for sugarcane, paddy, cotton, ragi and other crops. Results of a *Kar* ragi subvention farm at Hunsur are given below:—

Yield Statement of the Kar Ragi Subvention Farm, Hunsur

Variety	Area of the plot		Yield of the plot		Yield per acre	
	Acres	Guntas	Grain	Straw	Grain	Straw
			Srs.	lbs.	Srs.	lbs.
E.S. 13 ragi ..	0	37¼	210	2,000	551	2,162
K.1. ,, ..	0	20	260	1,000	520	2,000
E.S. 11 ,, ..	1	23½	820	3,130	520	1,984
E.C. 593 ,, ..	0	35	385	790	490	902
H.K. 82 ,, ..	0	11	105	400	381	1,454

This represents an improvement of about 20 per cent. by the use of improved strains.—(EDITOR.)

SELECTIONS

Coffee Market Expansion Ordinance

Ordinance No. XIII of 1940, to provide for assistance to the coffee industry by regulating the export of coffee from and the sale of coffee in British India and by other means, was published in the *Gazette of India* on 14th December 1940. The Ordinance is a fairly comprehensive one containing 49 sections. The following is a brief summary of the Ordinance:—

Sections 1 *to* 3 are introductory and include definitions of all terms used in the Ordinance.

Sections 4 *to* 10 deal with the constitution of the Indian Coffee Market Expansion Board and the appointment of the Controller of Coffee.

Sections 11 *to* 13 deal with the collection of customs duty on coffee exported and excise duty on coffee produced and released for sale in India. In both cases the rate is laid down as not to exceed Re. 1 per cwt.

Sections 14 *and* 15 deal with the registration of owners of coffee estates. Every person owning land planted with coffee plants aggregating not less than 25 acres, whether such land is comprised in one estate or in more than one estate and whether it is situated wholly or only partly in British India, shall before the expiration of one month from the commencement of this Ordinance, apply to the registering officer appointed in this behalf by the Provincial Government to be registered as an owner and in respect of each estate owned by him.

Section 35 provides that failure to register shall be punishable with a fine which may extend to Rs. 1,000 and to a further fine which may extend to Rs. 500 for each month after the first during which such failure continues.

Sections 16 *to* 26 govern the control of sale, exports and re-imports of coffee. In the first place, the Central Government may fix a maximum price or prices at which coffee may be sold wholesale in the Indian market, above which rate no registered owner or licensed curer shall sell any coffee. Further, no registered owner shall sell uncured coffee (including pounded coffee) direct from an estate except under and in accordance with the provisions of a licence procured from the Board under Section 24, nor shall he sell cured coffee (including pounded coffee) otherwise than through a curing establishment licenced under Section 28. Any registered owner who sells coffee in contravention of these Sections is liable to a fine extending to Rs. 1,000 and the Board may thereafter deduct from any payment

to be made under Section 34 to such registered owner a sum equal to the value, as estimated by the Board, of the coffee unlawfully sold.

No coffee can be exported except by the Board. This, however, does not apply to coffee sent out of British India by post, or carried in a passenger's luggage for his personal use.

As soon as may be after the commencement of this Ordinance, the Board will allot to each registered estate an internal sale quota for the year which will be a fixed percentage, common to all registered estates, of the probable total production of the estate as estimated by the Board. Registered owners are bound to furnish all returns prescribed by the Board and false returns are punishable with a fine which may extend to Rs. 1,000. The Board may authorise an officer to visit any estate to verify the accuracy of any return made under this Section or to ascertain the productive capacity of the Estate.

Registered owners must obtain from the Board a licence for the sale of uncured coffee.

All coffee produced by registered estates in excess of the amount specified in the internal sale quota shall be delivered to the Board for inclusion in the surplus pool, and procedure is laid down as to the delivery of such coffees, and its classification valuation which will be determined by the Board. All coffees in the surplus pool shall be marketed by the Board.

Sections 27 to 29 deal with curing of coffee. Every establishment for curing coffee shall obtain from the Board a licence to operate as such and maintain accounts in such forms as may be required by the Board. No registered owner may send coffee to be cured elsewhere than in a licenced curing establishment, whether the curing establishment is maintained by himself or by another person. A registered owner when sending coffee to a curing establishment shall report to the Board separately for each estate from which coffee is sent and the amount of coffee sent; and the curing establishment shall under instructions by the Board, apportion each consignment into two parts, one part consisting of coffee intended for internal sale and one part of coffee intended for the surplus pool.

Sections 30 to 34 deal with finance and funds to be kept by the Board. There are two main funds, the general fund into which customs and excise duties are paid, and the pool fund which receives all sums realised by sales of coffee from the pool. The Board shall at such times as it thinks fit make to registered owners, who have delivered coffee to the pool, such payments out of the pool fund as it may think proper in the same proportion as the value of the coffee delivered by a registered owner during the year to the surplus pool bears to the value of all coffee delivered to the surplus in the year.

Sections 25 *to* 40 deal with penalties and procedure. No court other than the Court of a Magistrate of the first class shall take cognizance of any offence punishable under this Ordinance.

Sections 41 *to* 46 are general Sections with reference to the powers of the Board, control by the Central Government, appeals to the Central Government, inspection of records and the keeping of accounts.

Section 47 lays down that nothing in this Ordinance shall apply to or affect any contract for the sale of coffee entered into before the third day of December 1940, if, before the expiration of 21 days from the commencement of this Ordinance, the owner of the coffee estate or the exporter who has effected the contract has furnished to the Board particulars of such contract; but all contracts made on or after the said date shall on the commencement of this Ordinance, in so far as they are at variance with the provisions of this Ordinance, be void.

Section 48 lays down the powers of the Central Government to make rules under the Ordinance.

Section 49 provides for so long as this Ordinance remains in force the Indian Coffee Cess Act, 1935, shall be deemed to be repealed.

This Ordinance extends to the whole of British India and comes into force on such date as the Central Government may, by notification in the official *Gazette,* appoint and is not to remain in force after the 31st of August 1941.

The Planters' Chronicle, Vol. XXXVI, No. 1
(January 4, 1941).

The Germination of Sugarcane

Although the mechanics of planting sugarcane are comparatively simple, involving cutting the cane stem into short pieces, dropping these into a furrow, and covering them with earth, the operation is one which depends for success on other factors that are internal or external to the seed piece.

One of the most influential of the external factors is temperature. This was proved by planting one set of flats in direct sunlight, another in a well-ventilated greenhouse and a third in the heavy shade of some trees. In one series the temperature of the soil in the flats in the open, exposed to direct sunlight, ranged from 75° F. upwards to an average daily maximum of 91·8° F. that in the greenhouse, from 75° F. to an average daily maximum of 88° F., and that in the deep shade from 69° F. to 73·4° F. The highest temperature compares with very favourable field conditions, while the low temperature is about the average condition found in cloudy areas during the winter months.

Results of the series of experiments above referred to are given in the accompanying table.

Effect of Soil Temperature on Germination

Age of seed pieces	Soil temperature average daily maximum (deg. F.)	Per cent. emergence	Average emergence time (days)
Upper third	91·8	93·3	10·3
	88·0	88·9	12·7
	73·4	50·5	20·4
Middle third	91·8	74·4	13·5
	88·0	64·7	13·8
	73·4	31·8	21·9
Lower third	91·8	77·7	13·8
	88·0	66·6	14·2
	73·4	45·2	24·2

It is clear from the data that soil temperatures exert a tremendous influence on the germination process. Germination at 70° F. or slightly above is roughly one half of what it is at the higher temperature, and the time of emergence is nearly doubled. Measurements of soil temperatures in Hawaiian cane fields show a range of 73·4° to 84·2° F. from December to June. Under such conditions the late fall and early winter are marginal or sub-marginal for germination. However, even in these seasons the upper inch of soil has a tendency to warm up intermittently, which emphasizes the desirability of shallow planting in cool or cloudy seasons.

The two external factors next in importance are soil aeration and soil moisture. The necessity of aeration was demonstrated by planting cane in a warm, moist but badly puddled soil; not a bud emerged. In heavy soils it is advisable to barely cover the seed. In loose, warm soils the depth may be four inches but deeper planting in such soils in cool seasons resulted in 25 per cent. germination and a 50 per cent. stand. The necessity of moisture is self-evident.

The internal factors that influence germination of seed cane are the age of the seed pieces, their length, position of buds, composition of seed pieces, and presence or absence of leaf-sheaths (trash). As to age of seed pieces, it is well-known that body pieces are less desirable for planting than top pieces; the old buds will produce slower growing shoots and a lower germination percentage and are less successful under unfavourable temperature and aeration conditions.

As to placing the bud in the furrow "up", "down" or "sideways" it was found that the "up" buds being nearest the surface, came

through first; the "down" buds require twice as much time, and the others are intermediate.

As regards length of seed piece, the longer it is, the lower the germination percentage and the lower the average shoot vigour. To use pieces with more than three buds is to waste the etxra buds. Nearly all the "down" buds are wasted.

The presence of trash (leaf-sheath) slows up emergence and reduces germination; whether it will pay to remove the sheath depends on local conditions. As to composition of the planting material, soft and succulent pieces easily rot and suffer damage. Hard material is slow in germination.

It seems desirable to take young cane at six or seven months, "hardened" and treated with nitrogen fertilizer about two weeks before cutting and planting. Soaking in warm water (85° to 95° F.) for 24 or 48 hours gives substantially improved germination and vigour, especially if the water contains about one per cent. of calcium nitrate.—H. F. Clements: "Facts about Sugar," *Sugar Abstracts*, November 1940. —*The South African Sugar Journal*, January 1941.

Twenty-five Years of Illinois Crop Costs, 1913–1937

(*A Review*)

A comprehensive study of crop costs is given under the above heading, by R. H. Wilcox and H. C. M. Case, in Bulletin No. 467 of the University of Illinois Agricultural and Experiment Station. Apart from its local interest to the State of Illinois in America, it contributes to the clarification of several points wherever cost accounting studies are under consideration.

The paragraph on selection of co-operators is interesting. "Care was taken", it is explained, "to select as co-operating farmers in each area, those who were in general representative of the farmers of the area with respect to ability, landholdings, type of farming in which engaged and financial standing. It was not always possible, however, to include only those whose farms and farming were typical of the locality, for first consideration had to be whether the farmer could and would keep the records required of him. Thus it was perhaps unavoidable that the group selected would be somewhat more efficient, on the average, than the other farmers of the community—for the inefficient farmers would naturally be less willing to undertake the keeping of accounts. Nevertheless, inasmuch as a route-man called upon each co-operator regularly at least once a week to supervise the

accounts during the early year of the study and thereby greatly reduced the burden to the farmer, it was possible to obtain records from some men who would otherwise have been unwilling or unable to keep detailed cost accounts."

It was by this means of engaging touring supervisors to visit selected farmers that costs for paddy, sugarcane and cotton were collected in this country also a few years back and there is a similarity with regard to the attitude of the farmers towards keeping accounts as well.

"Daily records of labour, feed, cash and other items kept by the co-operating farmers were gathered by the route-men on the regular visits to the co-operators", it is said, "and were brought to the Experiment Station, where the cost of production for each of the productive enterprises on the farms was ascertained by the use of the Journal, double entry ledger, and sound cost accounting procedure". After this centralisation, the figures are in the hands of an expert agency which can analyse them to any degree of detail possible.

The description under "methods used in analysing costs" has some useful suggestions. The Alternative Price System is supported on the ground that it seems to separate each of the major enterprises so that it may be judged on its own merits, enabling one to arrive at the relative profitableness of the different enterprises. Thus a commodity or labour entering into an enterprise, for example, feed to live-stock would be priced according to the market value of the quantity and not at the actual cost of its production on the farm. Money basis for all costs is supported by the explanation that though many of the cost items involve very little direct cash outlay and it is possible to express costs of production in terms of hours of labour, bushels of seed, gallons of fuel for tractor, bushels of grain and tons of hay, such terms of measurement are burdensome and difficult to apprehend quickly and a common monetary basis with which farmers have a great deal to do would be more serviceable. It is stated in continuation that quantity measures are also necessary for adjustments of farm organisation and the use of farm cost data over a considerable period of time.

Labour and power required for each farm enterprise are figured under the headings, man labour hours, horse labour hours, and tractor use hours. The balance sheets are drawn on the following general model.

TOTAL ACRE COST MADE UP OF:

(*a*) *Growing and harvesting costs per acre—*

Man labor.
Horse labor.

Tractor use.
Machinery.
Seed.
Twine.
Fuel.
Threshing.
Manure and Fertiliser.
General Farm expense.
Miscellaneous.

(*b*) *Land charges per acre*—
Taxes.
Interest on land at 5%.

INCOME PER ACRE FROM:
Grain.
Roughage.
Pastures, etc.

Such figures as yield per acre in bushels, value of land per acre, net cost per bushel and price per bushel are noted.

A long-range study of costs has brought out some fundamental trends which are worth noting. The greater efficiency in production of crops is evident in (1) a general reduction in operating costs of production and (2) the maintaining of yield levels in spite of the probable decline in the fertility of the soil.

Less and less of man labor has been required for crop production as efficiency has increased and this has led to a reduction in amount of labor available on the farms. A change from horse power to tractor power has meant a smaller attention paid to the distribution of land and labor to different crops and a trend towards higher proportions of land in crops that demand attention at the same time. Less unpaid family labour on the farms and fewer hours of work by the operators have given more time for recreation and self-improvement and reduction in time required for raising crops has led to an increase in the handling of live-stock, a practice altogether desirable. The unfortunate aspects of the changes—more mechanisation and less labour entering into crop production—are also mentioned. The farm affords less opportunity for employment and a larger proportion of farm expenses composed of cash expenses places the farm often at a disadvantage when prices of machinery and fuel bought are relatively high as compared with the prices of farm products.

Studies of farm costs are useful inasmuch as a knowledge of the exact position of the farming business is a great stride towards adjustments wherever necessary. M. V.

Our Exchange List

1. The Modern Review, Calcutta.
2. The Mysore Economic Journal, Bangalore.
3. The Madras Agricultural Journal, Agricultural College, Coimbatore.
4. The Implement and Machinery Review, London.
5. The Journal of the Mysore Engineering Association, Bangalore.
6. Malayan Agricultural Journal, Federated Malay States, Kuala-lumpur.
7. Review of Applied Entomology, The Imperial Bureau of Entomology, London.
8. Indian Farming, New Delhi.
9. The Tropical Agriculturist, Peradeniya, Ceylon.
10. Publications of the Department of Agriculture, Colony and Protectorate of Kenya, Nairobi, British East Africa.
11. Bulletin of Deli Proef Station, Medan, Deli (East Coast of Sumatra).
12. (Deleted.)
13. Publications of the Department of Agriculture and Labour, Government of Porto Rico, San Juan P. R.
14. Lingnan Science Journal, Lingnan University, Hongkok, Canton, China.
15. The Indian Veterinary Journal, Madras.
16. Bulletins of Agricultural Experiment Station, State College of Washington, Pullman, Washington.
17. The South African Sugar Journal, Durban, South Africa.
18. Bulletins of the Agricultural Experiment Station, Georgia, U.S.A.
19. Do. do. University of Maryland, Maryland, U.S.A.
20. Do. do. New Brunswick, U.S.A.
21. Do. do. The Pensylvania State College, Pensylvania, U.S.A.
22. Do. do. Michigan State College, Michigan, U.S.A.
23. Do. do. University of New Hampshire, Durham, N.H., U.S.A.
24. Do. do. University of Idaho, Idaho, Moscow, U.S.A.
25. Bulletin of the Colorado Experiment Station, Colorado, U.S.A.
26. Do. Missouri College of Agriculture, Columbia, Missouri, U.S.A.

27. Bulletin of the Agricultural Experiment Station, Stillwater (Oklahoma), U.S.A.
28. Do. University of Arizona, Tucson, U.S.A.
29. Do. Brookings, South Dakota, U.S.A.
30. Bulletins of the Agricultural Experiment Station, La Fayette, Indiana, U.S.A.
31. Do. do. Gainesville, Florida, U.S.A.
32. Do. do. Newark, Delaware, U.S.A.
33. Do. do. Fruit Station, Missouri, U.S.A.
34. Do. do. Corvallis Oregon, U.S.A.
35. Do. The Virginia Truck Experiment Station, Norfolk, Virginia, U.S.A.
36. Bulletins of the Agricultural Experiment Station, Pineapple Canner's Station, Honolulu, Hawaii, U.S.A.
37. Bulletins of the West Virginia University, West Virginia, U.S.A.
38. Bulletins of the Agricultural Experiment Station, University of Nebraska, Lincoln, Nebraska, U.S.A.
39. Do. do. University of Montana, Montana, U.S.A.
40. Do. do. Virgin Islands, U.S.A.
41. Do. do. Texas, U.S.A.
42. Union Des Agricultures, D'Egypte, Cairo, Africa.
43. Bulletins of the Virginia Agricultural Experiment Station, Blacksbury, Virginia, U.S.A.
44. Bulletins of Agricultural Experiment Station, Island of Guam, Guam, U.S.A.
45. Do. do. University of Illinois, Illinois, U.S.A.
46. Bulletins of the University Library, University of California, Berkeley, California, U.S.A.
47. Philippine Agriculturist, Laguna, Philippine Islands.
48. Bulletins of the State College of Washington, Western Washington Experiment Station, Puyallup, Washington, U.S.A.
49. Bulletins of the South Carolina Experiment Station, Clemson College, South Carolina, U.S.A.
50. Bulletins of the Agricultural Experimental Station, Logan, Utah, U.S.A.
51. The New Zealand Journal of Agriculture, Department of Agriculture, Wellington, New Zealand.
52. The Journal of the Madras Provincial Co-operative Union, Madras.
53. Industry, Calcutta.
54. Bulletins of the Department of Agriculture, Canada.
55. Tamil Nadu Co-operative Federation Journal, Coimbatore.
56. Publications of U.S. Department of Agriculture, Washington, U.S.A.

57. Bulletins of the Minnesota Agricultural Experiment Station, University Farm, Minnesota, U.S.A.
58. Bulletin of the Imperial Institute, London.
59. Publications of the Imperial Bureau of Soil Science, England.
60. Bulletins of the Rhode Island State College Agricultural Experiment Station, Kingston, Rhode Islands, U.S.A.
61. Cyprus Agricultural Journal, Cyprus.
62. Bulletin of the Pan American Union, Washington, D.C., U.S.A.
63. Journal of the Department of Agriculture of Victoria, Melbourne.
64. Bulletins of the Agricultural Experiment Station, Wooster, Ohio, U.S.A.
65. Bulletins of the Vermont Agricultural Experiment Station, Berlington, Vermont, U.S.A.
66. Bulletins of the Imperial Bureau of Fruit Production, England.
67. Publications of the Science Museum, London.
68. Nagpur Agricultural College Magazine, Nagpur, India.
69. Publications of the Indian Central Cotton Committee, Bombay.
70. The Journal of the Jamaica Agricultural Society, Jamaica.
71. Bulletins of New York State College of Agriculture, Ithaca, New York.
72. Hyderabad Farmer, Hyderabad Farming Association, Hyderabad (Dn.).
73. Publications of the National Agricultural Research Bureau, Nanking, China.
74. Annual Report and Seasonal Notes of the Department of Agriculture, Punjab, Lahore.
75. Poona Agricultural College Magazine, Poona.
76. Mysore Information Bulletin, Bangalore.
77. Kisan, Khagoul Road, Patna.
78. Publications of the Society of Biological Chemists, India, Bangalore.
79. Indian Information, New Delhi.
80. Bombay Information, Bombay.
81. The Bengal Weekly, Alipore, Bengal.
82. Market Report and Bulletin, The Mysore Chamber of Commerce, Bangalore.

671·41 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent